UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 10/622,403 | 07/18/2003 | Richard C. Slater | TXT05-06 | 4136 |

57604 7590 01/26/2006

DAVID E. HUANG, ESQ.
BAINWOOD HUANG & ASSOCIATES LLC
2 CONNECTOR ROAD
SUITE 2A
WESTBOROUGH, MA 01570

| EXAMINER | |
|---|---|
| VAN ROY, TOD THOMAS | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2828 | |

DATE MAILED: 01/26/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/622,403 | SLATER, RICHARD C. | |
| | Examiner | Art Unit | |
| | Tod T. Van Roy | 2828 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *21 November 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-35* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-35* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

## DETAILED ACTION

### *Response to Amendment*

The examiner acknowledges the amending of claims 3, 6-7, and the addition of claims 30-35.

### *Response to Arguments*

Applicant's arguments filed 11/21/2005 have been fully considered but they are not persuasive.

With respect to claims 1-29, the applicant contends that Vetrovec does not disclose two fields being present in the unstable resonator system. The examiner believes that more than one field can be thought to be present as the amplitude and direction of propagation of the original field would change with each pass through the gain media, and subsequent reflection off of the mirror surface, producing differing fields at each interface. The fields are then believed to be in phase for the reasons given below in the rejection of claim 1. As the claim language states a first field produced by a first gain media and a second field produced by a second gain media, without any further limiting language as to the nature of the fields, it is believed that the publication by Vetrovec reads on the claims for the reasons stated above.

Please see below for the rejection of new claims 30-35.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-4, 8-10, 13, 18-25, and 27-29 are rejected under 35 U.S.C. 102(e) as being anticipated by Vetrovec (US 2002/0172253).

With respect to claim 1, Vetrovec discloses a system for coherent beam combination comprising: an unstable resonator (fig.3), at least two gain media located within said unstable resonator (fig.3 #82's); wherein a first electromagnetic field produced by a first gain medium of said at least two gain media propagates through a portion of a second gain medium of said at least two gain media after one or more roundtrips within said unstable resonator (fig.3, first field produced at gain medium one, proceeds then to gain medium two); wherein said first electromagnetic field is in-phase with a second electromagnetic field produced by said second gain medium (fields in phase as the successive gain material is of the same type, leading to equal amounts of optical delay for both entering and exiting each gain region, keeping the fields in phase).

With respect to claim 2, Vetrovec discloses the system as outlined in the rejection to claim 1, and further discloses an output beam exiting the resonator (fig.3 top right corner, [0071]).

With respect to claim 3, Vetrovec discloses the system as outlined in the rejection to claim 1, and further discloses the output beam to be a function of the product of the amplitudes generated by each gain element ([0068], beam being amplified at each gain element in the series, product of the amplitudes then output at end of the resonator).

With respect to claims 4 and 13, Vetrovec discloses the system as outlined in the rejection to claim 1, and further discloses the gain media are laser gain media of the Ti:Saphhire type ([0077]).

With respect to claim 8, Vetrovec discloses the system as outlined in the rejection to claim 1, and further discloses the system to comprise a heat-conducting element in contact with the gain media ([0090-91], in heat conducting Al frame, with coolant lines run throughout).

With respect to claim 9, Vetrovec discloses the system as outlined in the rejection to claim 8, and further discloses the heat conducting element lie in a plane transverse to a longitudinal axis of the resonator (fig.14, longitudinal axis running down center of support/heat conductor, conductor lying in plane transverse to the longitudinal axis).

With respect to claim 10, Vetrovec discloses the system as outlined in the rejection to claim 9, and further discloses the heat conductor to contact portions of the gain media parallel to the longitudinal axis (fig.14, heat conductor surrounding the media, including sides parallel to the longitudinal axis as defined as running down hollow center of the structure).

With respect to claims 18 and 19, Vetrovec discloses the system as outlined in the rejection to claim 1, and further discloses there to be at least four gain media (fig.3), in a 2x2 array (fig.3, gain media arranged in a substantially 2x2 array formation).

With respect to claim 20, Vetrovec discloses the system as outlined in the rejection to claim 1, and further discloses the resonator to be negative or positive branch ([0071] bottom of paragraph).

With respect to claim 21, Vetrovec discloses the system as outlined in the rejection to claim 1, and further discloses the resonator be a confocal unstable resonator ([0071], middle of paragraph).

With respect to claim 22, Vetrovec discloses the system as outlined in the rejection to claim 21, and further discloses the confocal resonator is confocal convex ([0071], described in mirror configuration).

With respect to claim 23, Vetrovec discloses the system as outlined in the rejection to claim 1, and further discloses the resonator is an unstable ring resonator ([0078]).

With respect to claim 24, Vetrovec discloses a method for coherent beam combination comprising the steps of: producing a first electromagnetic field from a first gain medium; producing a second electromagnetic field from a second gain medium (fig.7, fields produced by pumping the gain media, then being reflected through successive gain media); expanding said first and said second electromagnetic fields in an unstable resonator having a magnification factor ([0080]); and coherently combining

said expanded first electromagnetic field with said expanded second electromagnetic field (accomplished through the in-phase reflections through the gain media).

With respect to claim 25, Vetrovec discloses the method as outlined in the rejection to claim 24, and further discloses the output beam to be a function of the product of the amplitudes generated by each gain element ([0068], beam being amplified at each gain element in the series, product of the amplitudes then output at end of the resonator).

With respect to claim 27, Vetrovec discloses the method as outlined in the rejection to claim 24, and further discloses producing and expanding at least a third electric field in the resonator (produced by gain medium 3 in the series).

With respect to claim 28, Vetrovec discloses the method as outlined in the rejection to claim 27, and further discloses coherently combining the third field with the first two fields (accomplished through the in-phase reflections through the gain media).

With respect to claim 29, Vetrovec discloses the method as outlined in the rejection to claim 24, and further discloses removing heat from the gain media ([0090-91], in heat conducting Al frame, with coolant lines run throughout).

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 24, and 30-35 are rejected under 35 U.S.C. 102(b) as being anticipated by Seguin (US 5210768).

With respect to claim 1, Seguin discloses a system for coherent beam combination comprising: an unstable resonator (fig.5), at least two gain media located within said unstable resonator (fig. #'s 10); wherein a first electromagnetic field produced by a first gain medium of said at least two gain media propagates through a portion of a second gain medium of said at least two gain media after one or more roundtrips within said unstable resonator (fig.5, first field produced at gain medium one, proceeds then to gain medium two); wherein said first electromagnetic field is in-phase with a second electromagnetic field produced by said second gain medium (abs., fields in phase as the successive gain material is of the same type, leading to equal amounts of optical delay for both entering and exiting each gain region, keeping the fields in phase).

With respect to claim 24, Seguin discloses a method for coherent beam combination comprising the steps of: producing a first electromagnetic field from a first gain medium; producing a second electromagnetic field from a second gain medium (fig.5, fields produced by pumping the gain media, then being reflected through successive gain media); expanding said first and said second electromagnetic fields in an unstable resonator having a magnification factor (inherent in an unstable resonator, see applicant's spec [0020]); and coherently combining said expanded first electromagnetic field with said expanded second electromagnetic field (abs., accomplished through the in-phase reflections through the gain media).

With respect to claims 30-35, Seguin further discloses the at least two gain media are placed in a plane transverse to a longitudinal axis of the unstable resonator,

each gain medium being positioned an equal distance away from and on a different side of the longitudinal axis of the unstable resonator, the at least two gain media are placed near the midpoint of the distance between first (fig.5 #20) and second (fig.5 #16) mirrors of the unstable resonator, and the at least two gain media are placed near the midpoint of the length of the unstable resonator.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 5, 15, 17, and 26 rejected under 35 U.S.C. 103(a) as being unpatentable over Vetrovec in view of Tanuma (US 5561550).

With respect to claims 5, 15, and 17, Vetrovec teaches the system as described in the rejection to claim 1 above, but does not teach the use of parametric gain media. Tanuma teaches an unstable optical resonator (col.2 lines 58-60) wherein Lithium

Niobate is used (col.1 lines 22-28). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the system of Vetrovec with the Lithium Niobate of Tanuma to utilize the parametric media's wavelength conversion abilities (col.1 lines 22-28) for use in industrial applications where specific wavelengths are needed and can be combined with the unstable resonator's high output power, as well as the ability of the media to provide gain in the resonator.

With respect to claim 26, Vetrovec teaches the method of claim 24, but does not teach signal or idler fields to be present. Tanuma teaches the use of Lithium Niobate in an unstable resonator, the reasons for incorporation given above, wherein the use of the parametric media in the resonator would inherently form both signal and idler fields.

Claims 5, 14, and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vetrovec in view of Velsko et al. (US 6421166).

With respect to claims 5, 14, and 16, Vetrovec teaches the system as described in the rejection to claim 1 above, but does not teach the use of parametric gain media. Velsko teaches an unstable resonator (claim 8) wherein PPLN (col.2 lines 50-53) is used. It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the system of Vetrovec with the parametric gain media of Velsko to achieve highly efficient frequency conversion (col.1 lines 55-62) for use in industrial applications where specific wavelengths are needed and can be combined with the unstable resonator's high output power, as well as the ability of the media to provide gain in the resonator.

Claims 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vetrovec in view of Reilly (US 6215807).

With respect to claim 6, Vetrovec teaches the system as outlined in the rejection to claim 1 above, but does not teach the spacing of the gain medium. Reilly teaches an unstable resonator (col.3 lines 7-10) with a spacing of the gain medium of 3mm (col.9 lines 12-15). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the system of Vetrovec with the suggested spacing of Reilly to achieve the highest possible output power while keeping the heating of the gain media within acceptable limits (col.1-2 lines 60-1).

With respect to claim 7, Vetrovec and Reilly teach the system as outlined in the rejection to claim 6 above, including the importance of gain spacing (see above rejection) but do not specify the separation distance be about 1mm. It would have been obvious to one of ordinary skill in the art at the time of the invention to optimize the range through experiment as this has been shown to be within the skill of a general worker in the art (see MPEP 2144.05 II A - In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) – speaking of the fact that it is not inventive to discover the optimum or workable ranges by routine experimentation, i.e. changing the spacing between the gain media)

Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vetrovec in view of Mooradian (US 5115445).

With respect to claims 11 and 12, Vetrovec teaches the system as outlined in the rejection to claim 8 above, but does not teach the heat conducting element to be made of optical quality diamond. Mooradian teaches an unstable resonator (col.6 lines 50-53) wherein an optical quality diamond is used to remove heat from the gain media (col.5 lines 15-29, obvious the diamond is of optical quality as it is directly in the beam path, fig.1 #16). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the heat conducting element of Vetrovec with the optical quality diamond material of Mooradian as diamond is known to have a good heat conductivity (col.5 lines 20-25) and would potentially eliminate the need for additional fluid cooling, and hole drilling (for beam passage, due to the optical quality material being used) of the heat conducting structure.

## *Conclusion*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tod T. Van Roy whose telephone number is (571)272-8447. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Minsun Harvey can be reached on (571)272-1835. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

TVR

MINSUN OH HARVEY
PRIMARY EXAMINER